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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BMT1814 – MANAGERIAL MATHEMATICS (All Sections / Groups)

12 OCTOBER 2016
2.30 p.m. - 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages, inclusive of a list of formulae.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1[Total =25 marks]

- a) Find a linear equation which parallel to a line $5y + 3x = 15$ and passes through point $(3, -2)$. [6 marks]
- b) On January 2011, Company A purchased a vehicle costing \$120,000. The company expects the vehicle to be operational for 4 years at the end of which it can be sold for \$50,000, where t is the age of the vehicle in years.
- What is the rate of depreciation of the vehicle's value yearly? [3 marks]
 - Find a linear equation that describes the value of the vehicle. Write the final answer in the form $V(t) = mt + b$. [4 marks]
- c) Solve the following linear programming problem using the corner point method.

$$\begin{aligned} \text{Max } Z &= 3x + 5y \\ \text{subject to } &4x + 4y \leq 48 \\ &x + 2y \leq 20 \\ &x, y \geq 0 \end{aligned}$$

[12 marks]

Question 2[Total =25 marks]

- a) Five and a half years ago, Rina invested \$10,000 in a retirement fund that grew at the rate of 10.82% compounded quarterly. What is her account worth today? [6 marks]
- b) How many years (to the nearest integer) will it take \$12,000 to grow to \$15,000 if the investment earns interest at the rate of 8% compounded monthly? [6 marks]
- c) The Martin couple is planning to go to Europe 3 years from now and have agreed to set aside \$150 per month for their trip. If they deposit this money at the end of each month into a saving account paying interest at the rate of 8% compounded monthly, how much money will be in their travel fund at the end of the third year? [6 marks]
- d) Teresa and Raul purchased a house for \$200,000. They made a down payment of 20% of the purchase price and secured a 30-year home mortgage at 6% per year compounded monthly on the unpaid balance. How much was their monthly mortgage payment for the house? [7 marks]

Continued....

Question 3 [Total =25 marks]

a) Find the derivatives of the following functions:

(i) $f(x) = 4x^5 + 3x^4 - 8x^2 + x + 3$ [3 marks]

(ii) $y = \frac{3}{x^3} + \frac{4}{\sqrt{x}} + 1$ [3 marks]

(iii) $f(x) = x^3(\sqrt{x} + 1)$ [4 marks]

b) Ditton Company manufactures an electrostatic speaker system. The quantity x of these speaker system demanded each week is related to the whole-sale unit price (in dollars) by the equation

$$p = -0.006x + 180 \quad (0 \leq x \leq 30,000)$$

The weekly total cost (in dollars) incurred by Ditton Company for producing x units is

$$C(x) = 0.000002x^3 - 0.02x^2 + 120x + 60,000$$

(i) Find the revenue function, $R(x)$ and the profit function, $P(x)$. [4 marks]

(ii) Find the marginal revenue function, $R'(x)$ and marginal cost function, $C'(x)$. [2 marks]

(iii) Find the marginal cost when the $x=7000$. Interpret the result. [3 marks]

c) For the following function: $f(x, y) = x^2 + xy + y^2 + 2x - y$

(i) Find the first partial derivatives, f_x and f_y . [4 marks]

(ii) Compute $f_x(-1,2)$ and $f_y(1,-2)$ [2 marks]

Question 4 [Total = 25 marks]

a) Integrate the following functions:

(i) $\int t^{\frac{3}{2}} + 2t^{\frac{1}{2}} - 4t^{-\frac{1}{2}} dt$ [4 marks]

(ii) $\int_1^2 1 + \frac{1}{x} + e^x dx$ [6 marks]

b) Solve the following indefinite integral using integration by substitution:

$$\int 3t^2 \sqrt{t^3 + 2} dt \quad [7 \text{ marks}]$$

c) Find the area bounded by the graph $f(x) = x + 3x^2$, the x-axis and the line $x=4$ to $x=8$.

[8 marks]

End of paper

LIST OF FORMULAE

Linear & Quadratic Equation

1. Quadratic Equation

Solution of quadratic equation : $ax^2 + bx + c = 0$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Mathematics For Finance

1. Simple Interest

Interest, $I = Prt$

Accumulated amount, $A = P(1 + rt)$ or $A = P + I$

2. Compound Interest

$$A = P(1 + i)^n \quad \text{where } i = \frac{r}{m} \quad \text{and } n = mt$$

3. Effective Rate of Interest

$$r_{\text{eff}} = \left(1 + \frac{r}{m}\right)^m - 1$$

4. Present Value for Compound Interest

$$P = A(1 + i)^{-n}$$

5. Annuity

$$S = R \left[\frac{(1+i)^n - 1}{i} \right] \qquad P = R \left[\frac{1 - (1+i)^{-n}}{i} \right]$$

6. Amortization

$$R = \left[\frac{Pi}{1 - (1+i)^{-n}} \right]$$

7. Sinking Fund

$$R = \left[\frac{iS}{(1+i)^n - 1} \right]$$

Derivative

Basic Rules of Differentiation

a) Derivative of a constant:

$$\frac{d}{dx}(c) = 0$$

b) Power rule:

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

c) Sum rule:

$$\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$$

a) Product rule:

$$\frac{d}{dx}[f(x) \cdot g(x)] = \frac{d}{dx}[f(x)]g(x) + \frac{d}{dx}[g(x)]f(x)$$

b) Quotient rule:

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x) \cdot \frac{d}{dx}[f(x)] - f(x) \cdot \frac{d}{dx}[g(x)]}{[g(x)]^2}$$

c) Chain rule:

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

d) General Power rule:

$$\frac{d}{dx}[u^n] = nu^{n-1} \frac{d}{dx}u$$

e) Logarithmic function:

$$\frac{d}{dx}(\ln u) = \frac{1}{u} \left(\frac{du}{dx} \right)$$

f) Exponential function:

$$\frac{d}{dx}(e^u) = e^u \frac{du}{dx}$$

Integration

Basic Rules of Integration

a) Indefinite integral of a constant:

$$\int k \, du = ku + C$$

b) Power rule:

$$\int u^n \, du = \frac{u^{n+1}}{n+1} + C$$

c) Sum rule:

$$\int [f(u) \pm g(u)] \, du = \int f(u) \, du \pm \int g(u) \, du$$

d) Logarithmic function:

$$\int \frac{1}{u} \, du = \ln u + C$$

e) Exponential function:

$$\int e^u \, du = e^u + C$$

Calculus of Several Variables

1. Determining Relative Extrema

$$D(x, y) = f_{xx}f_{yy} - f_{xy}^2$$

D(a,b)	$f_{xx}(a,b)$	Interpretation
+	+	Relative min. at (a,b)
+	-	Relative Max. at (a,b)
-		Neither max. or min. at (a,b)
0		Test is inconclusive

Others

1. Average Cost Function

$$\bar{C} = \frac{C(x)}{x}$$

2. Marginal Average Cost Function

$$\bar{C}'(x)$$